INTERNATIONAL RESEARCH JOURNAL OF ENGINEERING AND TECHNOLOGY (IRJET) E-ISSN: 2395 -0056
VOLUME: 04 ISSUE: 03 | MAR -2017 WWW.IRJET.NET P-ISSN: 2395-0072

Performance Analysis and Power Optimization for Optical Link Using Different Modulation Techniques

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Abstract—*Challenge faced by today's telecommunication network is the increasing demand of bandwidth and data rates. This rapid increase in data traffic in communication system has accelerated the development of high capacity optical fiber links, and the main barriers across these links are the dispersion and various nonlinear effects. Even the transmission limit is influenced due to distinctive scattering issues and power attenuation existing in optical fiber. In this paper optical fiber link at different transmission distance upto 300km is studied using two different modulation schemes. Paper shows the comparative analysis of two modulation schemes Non-Return to Zero (NRZ) and Return to Zero (RZ) for an optical network. The performance analysis is done on the basis of BER, Q-factor and Eye Diagram. Performance of link weakens as the transmission distance increases. It is observed that RZ gives better performance compared to NRZ modulation.*

Keywords—Optical link; RZ; NRZ; Optisystem

I. INTRODUCTION

In single channel transmission the RZ coded transmission achieves high performance because SPM can be compensated with fiber dispersion effects. In this modern time, the increasing traffic demands require larger bandwidth for high data rate communication. The high data rate transmission requires an increase in input launch power. In this paper, performance analysis of an optical communication system for 40 Gbps single mode transmission is done. When we deal with high data rate optical communication systems using SMF, the RZ transmission is suited well than NRZ because RZ has more compressed pulse version as compared to NRZ. EDFA optical amplifiers are used for the amplification of optical signals at various lengths of SMF. The transmission distance is limited by dispersion and non linear effects. In order to abolish dispersion effect, dispersion compensating fiber (DCF) is used in channel of an optical communication system.

The rest of the paper is organized as follows. Section 2 presents the architecture of simulated optical high speed system. And a 40 Gbps optical link is constructed and simulated by using Optisystem. In Section 3, the performance of the 40 Gbps single span optical network is analyzed. Finally, we conclude the paper in Section 4.

II. DESIGN AND SIMULATION SETUP

Proposed algorithm consists of a transmitter section with different modulation schemes (RZ and NRZ), optical fiber, receiver section and a BER analyzer to analyze the output result. The transmitter section consists of pseudo random bit sequence generator, optical source and Mach Zender modulator.

In transmission channel single mode fiber and dispersion compensating fiber along with optical amplifier is used. The length of the optical Single Mode Fiber (SMF) is varied and in accordance with the length of Dispersion Compensating Fiber (DCF) will vary respectively according to the equation

$$D_{SMF} \times L_{SMF} = -D_{DCF} \times L_{DCF}$$

Where,
D_{SMF} = Dispersion Coefficient of Single Mode Fiber
L_{SMF} = Length of Single Mode Fiber
D_{DCF} = Dispersion Coefficient of Dispersion Compensating Fiber
L_{DCF} = Length of Dispersion Compensating Fiber

Out of the three DCF compensation techniques, we have simulated our link using symmetric dispersion compensation configuration.

In receiver section PIN photodetector for converting optical signal to electrical signal is used followed by band pass filter.

In order to analyze the impact of nonlinearities on the optical fiber communication system, the transmission length of the optical system is varied. The result is analyzed using BER analyzer.

The simulation parameters are given as follows:

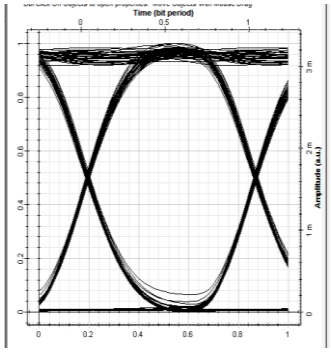
Parameters	Value
Bit Rate	40 Gbps
Modulation Format	RZ, NRZ
Transmission Distance	50 km x n spans (n=2,4,6)

(km)	
Length of SMF	50 km
Length of DCF	10 km
Dispersion coefficient of SMF	17ps/nm/km
Dispersion coefficient of DCF	-85ps/nm/km
DCF Scheme	Symmetric

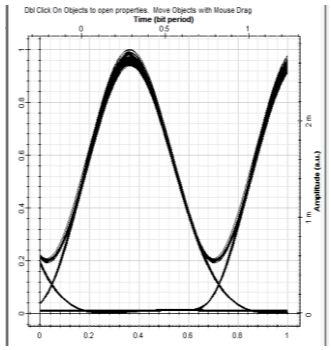
III. RESULTS

In this paper, we have simulated an optical link at 40 Gbps bit rate using two different modulation schemes namely Retutrn-to-Zero (RZ) and Non-Return-to-Zero(NRZ). The distance is varied from 100 km to 300km to analyze the performance to the link in terms of Q-factor, BER and eye diagram.

Figure 1 shows the eye diagram of optical link using RZ and NRZ modulation for 100 km fiber length.



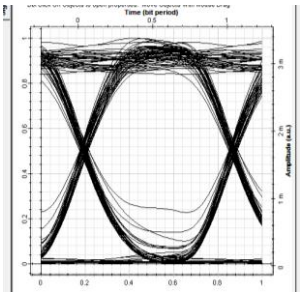
(a)



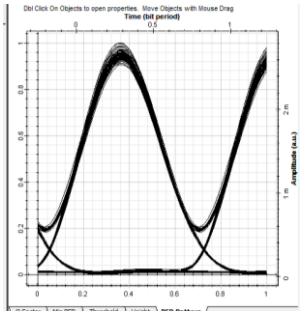
(b)

Figure 1: Eye Diagram (a) NRZ (b) RZ

Figure 2 shows the eye diagram of optical link using RZ and NRZ modulation for 200 km fiber length.



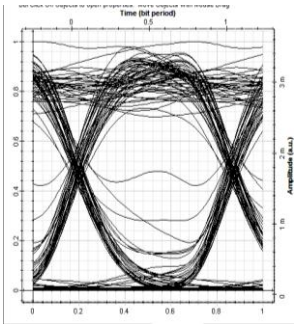
(a)



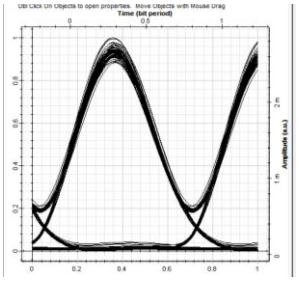
(b)

Figure 2: Eye Diagram (a) NRZ (b) RZ

Figure 3 shows the eye diagram of optical link using RZ and NRZ modulation for 300 km fiber length.



(a)



(b)

Figure 3: Eye Diagram (a) NRZ (b) RZ

Table 1 shows Q-factor value for NRZ and RZ fat varied fiber length.

TABLE 1: Q-Factor

Modulation	Distance		
	100 km	200 km	300 km
NRZ	43.1771	13.3985	6.19741
RZ	64.9336	40.5856	28.2801

IV. CONCLUSION

In this paper single span optical link with various modulation schemes namely NRZ and RZ at different transmission distance is simulated. From the obtained result, it is found that RZ modulation format shows the better performance than other formats.

REFERENCES

[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982]